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AN AS-1 PROGRAM TO COMPUTE ATTENUATION COEFFICIENTS ON THE UNIV--ETC(U)

JAN 70 R B MACDONALD

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NAVY UNDERWATER SOUND LABORATORY
NEW LONDON, CONNECTICUT 06320

AN AS-1 PROGRAM TO COMPUTE ATTENUATION COEFFICIENTS
ON THE UNIVAC 1230 COMPUTER

NUSL Problem No.
O-A-401-00-00
SF 11 552 001-11282

by

R. B. MacDonald

NUSL Technical Memorandum No. 2211-10-70

16 Jan 1970

INTRODUCTION

The program is called "ATTENLOSS" and assumes a table (RANGE) is filled in core with values of range and propagation loss in sets of two. The program then works on this table to calculate the attenuation coefficient (COEFF), the transitional range (INTERCEPT), a table of ranges (RANGE 1), and a table of adjusted propagation loss (ADJPRO). Additionally, the standard error of estimate (SEE) and the standard error of the regression coefficient (SERC) are calculated.

MATH MODEL

The equations in this program are essentially derived from the propagation loss equation of the following form:

$$PL - 10 \log R = \alpha R + H_0$$

where: PL = propagation loss in DB.

R = range in yards.

$H_0 = 10 \log R_0$ = the transitional range in DB or the point at which cylindrical rather than spherical spreading becomes the dominant loss mode.

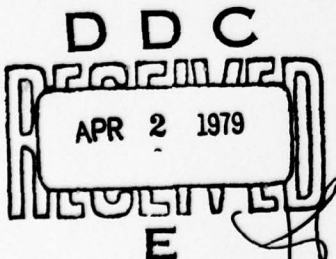
α = attenuation coefficient in DB/yard.

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The loss equation written in the above fashion is simply the equation for a straight line where $Y = PL - 10 \log R$, the adjusted propagation loss (ADJPRO), and $X = R$, the range. The transitional range H_0 is simply the Y intercept and α , which is the attenuation coefficient, is the slope of the line. The solution for α can then be written as:

$$\alpha = \frac{n \sum XY - \sum X \sum Y}{n(\sum X^2) - (\sum X)^2} \text{ in DB/yard}$$

where n = number of data points

Similarly:

$$H_0 = \frac{(\sum X^2) \sum Y - \sum X \sum XY}{n(\sum X^2) - (\sum X)^2} \text{ in DB}$$

An estimate of the "goodness of fit" of the data points to a straight line approximation may be made by calculating the standard error of estimate of the data points about the straight line which is given by:

$$SEE = \sqrt{\frac{\sum (\alpha R + H_0 - PL + 10 \log R)^2}{n-2}} \text{ in DB}$$

and the standard error of the regression coefficient, which tests the variability of the attenuation coefficient, and is given by:

$$SERC = \frac{SEE}{\sqrt{R^2}} \text{ in DB}$$

MATH DEVELOPMENT

The following statements list the solutions to the above equations in the manner in which they are solved in the program.

- 1) $\sum R$
- 2) $\sum R^2$
- 3) $10 \log R$
- 4) $PL - 10 \log R$
- 5) $R (PL - 10 \log R)$
- 6) $\sum R (PL - 10 \log R)$
- ADJPRO 7) $PL - 10 \log R$
- 8) $\sum (PL - 10 \log R)$

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- 9) $(\Sigma R)^2$
 10) $n(\Sigma R^2)$
 11) $n(\Sigma R^2) - (\Sigma R)^2$
 12) $\Sigma R \Sigma (PL - 10 \log R)$
 13) $n \Sigma R (PL - 10 \log R)$
 14) $n \Sigma R (PL - 10 \log R) - \Sigma R \Sigma (PL - 10 \log R)$
 COEFF 15) $n \Sigma R (PL - 10 \log R) - \Sigma R \Sigma (PL - 10 \log R) / n(\Sigma R^2) - (\Sigma R)^2$
 16) $\Sigma R \Sigma R (PL - 10 \log R)$
 17) $\Sigma R^2 \Sigma (PL - 10 \log R)$
 18) $\Sigma R^2 \Sigma (PL - 10 \log R) - \Sigma R \Sigma R (PL - 10 \log R)$
 INTERCEPT 19) $\Sigma R^2 \Sigma (PL - 10 \log R) - \Sigma R \Sigma R (PL - 10 \log R) / n(\Sigma R^2) - (\Sigma R)^2$
 20) αR
 21) $\alpha R + H_0$
 22) $\alpha R + H_0 - PL + 10 \log R$
 23) $(\alpha R + H_0 - PL + 10 \log R)^2$
 24) $\Sigma (\alpha R + H_0 - PL + 10 \log R)^2$
 25) $\Sigma (\alpha R + H_0 - PL + 10 \log R)^2 / n - 2$
 SEE 26) $\sqrt{\Sigma (\alpha R + H_0 - PL + 10 \log R)^2 / n - 2}$
 27) $\sqrt{\Sigma R^2}$
 SERC 28) $SEE / \sqrt{\Sigma R^2}$

PROGRAM INPUTS

The program computes only one coefficient per pass or one frequency at a time. An area of core called "RANGE" must be set aside and filled in the following manner:

Table "RANGE"

Cell 1	Range (1) in hundreds of yards, scaled 0 bits
Cell 2	Propagation Loss (1) in DB, scaled 3 bits
Cell 3	Range (2)
Cell 4	Propagation Loss (2)
Cell 5	Range (3) etc.

The range and propagation loss sets do not have to be in any particular order and the range may be either positive or negative, indicating an opening or closing run. The total number of cells used for Table "RANGE" is set into cell "LIMIT", scaled 0 bits.

PROGRAM OUTPUTS

The following are program outputs (which remain in core):

COEFF	=	Attenuation coefficient in DB, scaled 15D bits.
INTERCEPT	=	Transitional range in DB, scaled 9D bits.
SEE	=	Standard error of estimate in DB, scaled 9D bits.
SERC	=	Standard error of the regression coefficient in DB/unit range, scaled 9D bits.

Table ADJPRO, adjusted propagation loss and range in the following form:

Cell 1	Range (1) in kyds, scaled 3 bits
Cell 2	PL $-10\log R(1)$ in DB, scaled 3 bits
Cell 3	Range (2)
Cell 4	PL $-10\log R(2)$
Cell 5	Range (3) etc.

OPERATING INSTRUCTIONS

- 1) Load Table "RANGE"
- 2) Set "LIMIT" to number of values in table "RANGE"
- 3) RJP * ATTENLOSS

OTHER PROGRAMS REQUIRED FOR COMPILATION

CONLOGIT - Decibel conversion routine
FLPARITH - Floating point package

CORE REQUIREMENTS

214₁₀ cells for ATTENLOSS minus tables
96₁₀ cells for CONLOGIT
650₁₀ cells for FLPARITH

960₁₀ Total cells

COGNIZANT SCIENTIST

W. Thorp, Code 2211.2

Robert B. MacDonald
ROBERT B. MACDONALD
Physicist

Definition of Terms

NUSL Tech Memo
2211-10-70

1. RANGE1 - Table - Range values in kiloyards, scaled 3 bits.
2. QSUMR2 - Variable - Q register portion of floating point number for ΣR^2 .
3. ASUMR2 - Variable - A register portion of floating point number for ΣR^2 .
4. RANGE3 - Table - Range-propagation loss values. Range in hundreds of yards, propagation loss in DB. Range, unscaled; PL, scaled 3 bits.
5. SUMR - Variable - Sum of range values in kyds., scaled 3 bits.
6. LIMIT - Variable - Total number of values to be processed (range plus propagation loss), scaled 0 bits.
7. NOP - Variable - Holds count of total number of values processed, scaled 0 bits.
8. MTEMP - Variable - Temporary storage.
9. ASUMRNW - Variable - A register portion of floating point quantity for $\Sigma R(PL - 10 \log R)$.
10. QSUMRNW - Variable - Q register portion of floating point quantity for $\Sigma R(PL - 10 \log R)$.
11. ADJPRO - Table - Adjusted propagation loss $(PL - 10 \log R)$ in DB, scaled 3 bits.
12. NW - Variable - Sum of adjusted propagation loss $\Sigma(PL - 10 \log R)$ in DB, scaled 3 bits.
13. ASUMR - Variable - A register portion of floating point number for $(\Sigma R)^2$.
14. QSUMR - Variable - Q register portion of floating point number for $(\Sigma R)^2$.
15. ADIVISOR - Variable - A register portion of floating point number for $n(\Sigma R^2) - (\Sigma R)^2$.
16. QDIVISOR - Variable - Q register portion of floating point number for $n(\Sigma R^2) - (\Sigma R)^2$.
17. ANOP - Variable - A register portion of floating point number for n.
18. QNOP - Variable - Q register portion of floating point number for n.
19. ASUMR1 - Variable - A register portion of floating point number for ΣR .
20. QSUMR1 - Variable - Q register portion of floating point number for ΣR .
21. ASUMR - Variable - A register portion of floating point number for $\Sigma R(PL - 10 \log R)$.

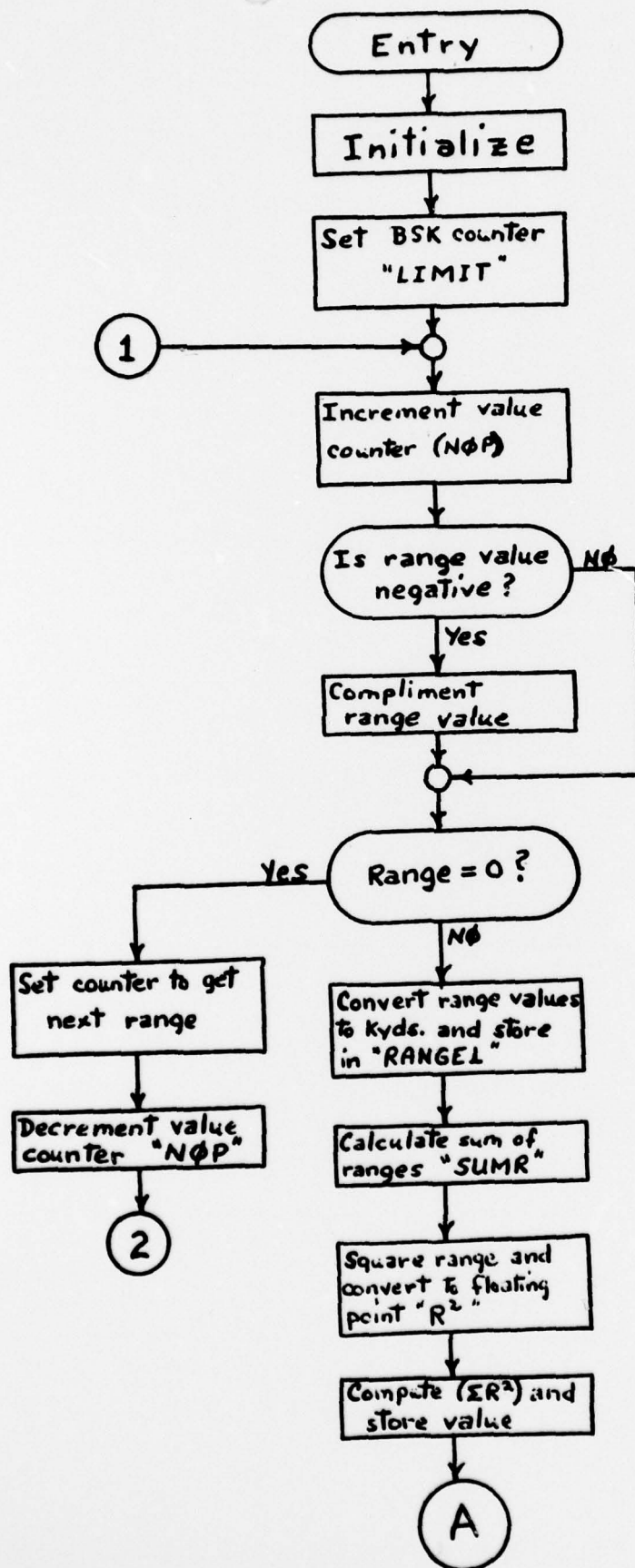
Definition of Terms (cont.)

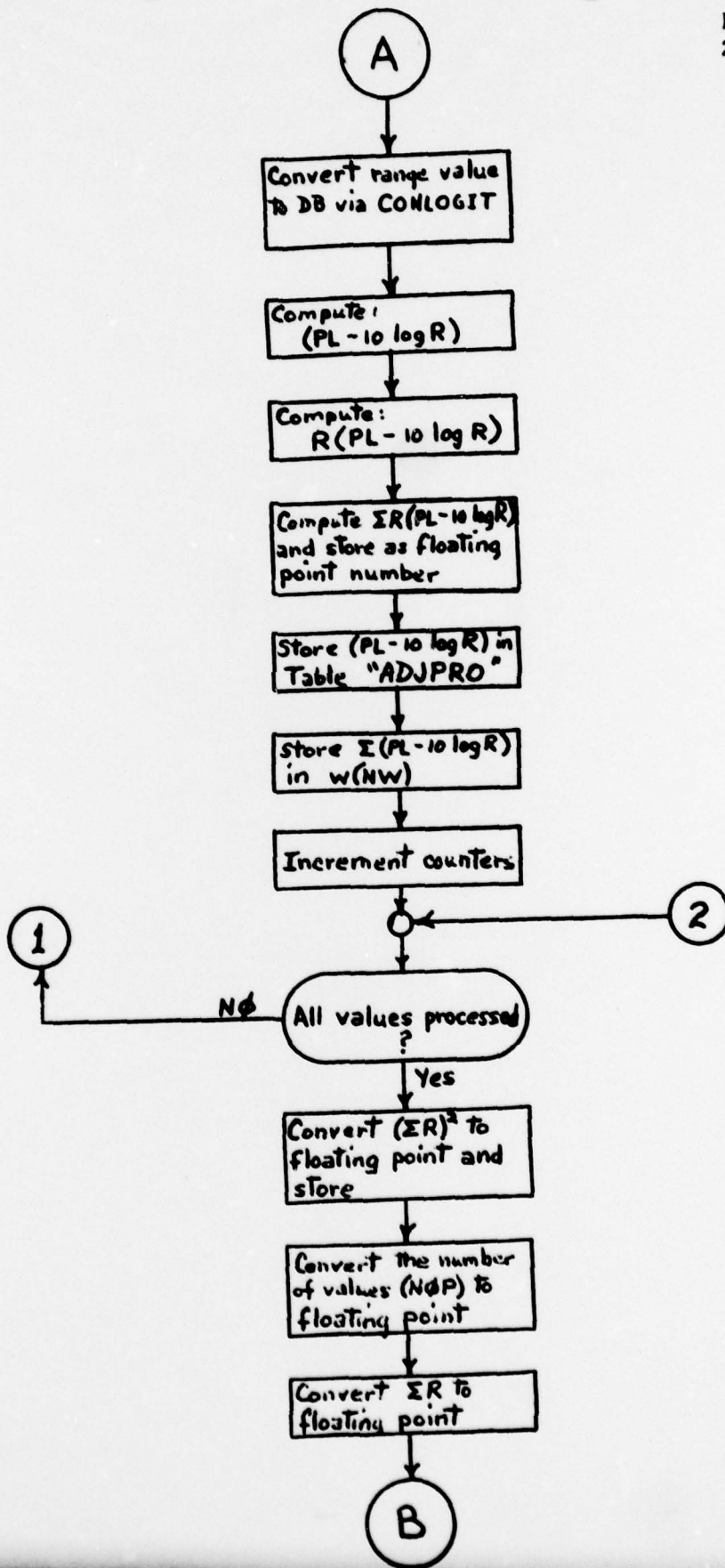
22. QSUBT - Variable - Q register portion of floating point number for $\Sigma R \Sigma (PL - 10 \log R)$.
23. COEFF - Variable - Attenuation coefficient in DB/yr., scaled 15D.
24. QRRNW - Variable - Q register portion of floating point number for $\Sigma R \Sigma (PL - 10 \log R)$.
25. ARRNW - Variable - A register portion of floating point number for $\Sigma R \Sigma (PL - 10 \log R)$.
26. INTERCEPT - Variable - Transitional range in DB, scaled 9D.
27. DIF - Variable - $\Sigma (R + H_0 - PL + 10 \log R)^2$, scaled 3 bits.
28. LIMIT2 - Variable - Total number of range (only) values, scaled 0 bits.
29. SYN - Variable - $\Sigma (R + H_0 - PL + 10 \log R)^2 / n - 2$, scaled 3 bits.
30. SEE - Variable - Standard error of estimate in DB, scaled 9D.
31. SERC - Variable - Standard error of the regression coefficient in DB/unit range, scaled 9D.

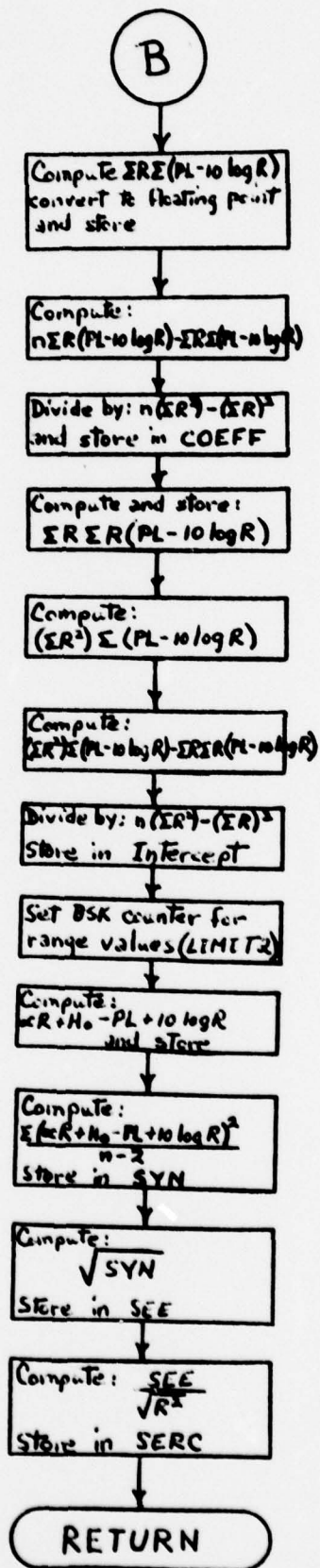
Floating Point Arithmetic Terms (FLPARITH)

1. FLENT - Enter floating point accumulator.
2. FLAD - Floating point add.
3. FLSE - Floating point subtract.
4. FLMP - Floating point multiply.
5. FLDV - Floating point divide.
6. FLSTR - Floating point store.
7. FLFLT - Fixed point to floating point conversion.
8. FLTFIX - Floating point to fixed point conversion.

FLOW DIAGRAM
Program "Attenloss"







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ATTN0001      C-CONTROL
ATTN0 02      ALLOCATION
ATTN0 03      BASE      20000
ATTN0 04      PROGRAM*MACDONALD*6JANUARY1969
ATTN0 13      LOC-DD
ATTN0 14      VRBL*SUMR*FXW'''SUM OF RANGE (YDS) SC 3
ATTN0 15      VRBL*NOP*FXW'''NUMBER OF RANGE VALUES
ATTN0 16      VRBL*ASUMR2*FXW'''SUM OF RNAGE SQUARED A REG. FLT PT
ATTN0 17      VRBL*QSUMR2*FXW'''SUM OF RANGE SQUARED Q REG. FLT PT
ATTN0 19      VRBL*ASUMRNW*FXW'''SUMR(NW-10LOGR) A REG. FLT PT
ATTN0 20      VRBL*QSUMRNW*FXW'''SUMR(NW-10LOGR) Q REG. FLT PT
ATTN0 21      VRBL*NW*FXW'''SUM(NW-10LOGR) SC 3
ATTN0 23      VRBL*ASUMR*FXW'''(SUM RANGE) SQUARED A REG. FLT PT
ATTN0 24      VRBL*QSUMR*FXW'''(SUM RANGE) SQUARED Q REG. FLT PT
ATTN0 25      VRBL*ADIVISOR*FXW'''NSUMR SQD.-(SUMR) SQD. AREG FLT
ATTN0026      VRBL*QDIVISOR*FXW'''NSUMR SQD.-(SUMR) SQD. QREG FLT
ATTN0 27      VRBL*ANOP*FXW'''NUMBER OF POINTS A REG. FLT. PT.
ATTN0 28      VRBL*QNOP*FXW'''NUMBER OF POINTS Q REG. FLT. PT.
ATTN0 29      VRBL*ASUBT*FXW'''SUMRSUM(NW-10LOGR) A REG. FLT PT
ATTN0 30      VRBL*QSUBT*FXW'''SUMRSUM(NW-10LOGR) Q REG. FLT PT
ATTN0 32      VRBL*QRRNW*FXW'''SUMRSUMR(NW-10LOGR) Q REG. FLT PT
ATTN0 33      VRBL*ARKNW*FXW'''SUMRSSUMR(NW-10LOGR) A REG. FLT PT
ATTN0 34      VRBL*SYN*FXW'''SUM(Y-YHAT)/N-2 SC 9
ATTN0 35      VRBL*DIF*FXW'''SUM(NW-10LOGR)A-(AR+H)P SC 6
ATTN0 36      VRBL*COEFF*FXW'''ATTEN COEFF(DB/YD) SC 15D
ATTN0 37      VRBL*INTERCEPT*FXW'''TRANSITION RANGE(DB) SC 9
ATTN0 38      VRBL*SERC*FXW'''STAN. ERROR OF REG. COEFF. SC 15D
ATTN0 31      VRBL*LIMI12*FXW'''NUMBER OF RANGE VALUES
ATTN0 18      VRBL*MTEMP*FXW'''TEMPORARY STORAGE
ATTN0 39      VRBL*SEE*FXW'''STAN. ERROR OF ESTIMATE SC 15D
ATTN0 22      VRBL*LIMIT*FXW'''TOTAL NUMBER OF POINTS(RANG + PROP)
ATTN          VRBL*ASUMR1*FXW'''SUM OF RANGES
ATTN          VRBL*QSUMR1*FXW'''SUM OF RANGES
ATTN0 40      END-LOC-DD
ATTN0 41      ATTNL      PROCEDURE*ATTENLOSS
ATTN0 42      ENT*B1*0'''INITIALIZE
ATTN0 43      ENT*Q*0'''INITIALIZE
ATTN0 44      MSTART    STR*Q*W(SUMR+B1)'''INITIALIZE SUMR
ATTN0 45      BSK*B1*30'''INITIALIZE OTHER VARIABLES
ATTN0 46      JP*MSTART
ATTN0 47      ENT*B2*0'''INITIALIZE
ATTN  48      RPL*Y-1*W(LIMIT)
ATTN0 49      MSTART1   RPL*Y+1*W(NOP)
ATTN  50      ENT*Q*W(RANGE+B1)*QPOS
ATTN  5005      CP*Q
ATTN  5010      STR*Q*A*AZERO
ATTN  5015      JP*MBACK
ATTN  5022      ENT*B1*1+B1
ATTN  5020      RPL*Y-1*W(NOP)
ATTN  5025      JP*MNG
ATTN0051      MBACK    ENT*A*0
ATTN005105     LSH*G*3
ATTN005110     DIV*12
ATTN  52      STR*Q*W(RANGE1+B2)
ATTN0 53      ADD*Q*W(SUMR)'''OBTAIN SUMR
ATTN0 54      STR*Q*W(SUMR)'''STORE
ATTN  55      ENT*Q*W(RANGE1+B2)
ATTN  56      MUL*W(RANGE1+B2)

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ATTN 57 LSH*AG*30'''SET OCTAL PT. BET. A AND Q REGISTERS
ATTN 58 RJP*FIXFLT'''RANGE SQUARED IN FLOATING POINT REG.
ATTN 59 ENT*A*W(ASUMR2)'''ENTER SUM RANGE SQUARED
ATTN 60 ENT*Q*W(QSUMR2)
ATTN 61 RJP*FLAD'''SUM R SQUARED IN FLT PT REGISTER
ATTN 62 RJP*FLSTR'''RESTORE R SQUARED TO A AND Q REGISTERS
ATTN 63 STR*A*W(ASUMR2)'''STORE PARTS
ATTN 64 STR*Q*W(QSUMR2)
ATTN 65 ENT*Q*W(RANGE1+B2)
ATTN 66 LSH*Q*14'''SET UP FOR CONLOGIT
ATTN 67 CONLOGIT'''INPUT SC 15D
ATTN 68 STR*Q*W(MTEMP)'''STORE TEMPORARILY DB VALUE SC 3
ATTN 69 ENT*Q*W(RANGE+1+B1)'''PROP LOSS VALUE SC 3
ATTN 70 SUB*Q*W(MTEMP)'''NW-10LOGR SC 3 IN DB
ATTN 71 MUL*W(RANGE1+B2)
ATTN 72 LSH*AG*30'''SET OCTAL PT BET A AND Q REGISTERS
ATTN 73 RJP*FIXFLT'''CONVERT R(NW-10LOGR) GO FLT PT
ATTN 74 ENT*A*W(ASUMRNW)'''SUM VALUES TO A AND Q
ATTN 75 ENT*Q*W(QSUMRNW)
ATTN0076 RJP*FLAD'''COMPUTE SUMR(NW-10LOGR) IN FLT PT
ATTN0077 RJP*FLSTR'''SET VALUE TO A AND Q REGISTER
ATTN0078 STR*A*W(ASUMRNW)'''STORE PARTS
ATTN0079 STR*Q*W(QSUMRNW)
ATTN0080 ENT*Q*W(RANGE+1+B1)'''PROP LOSS SC 3 IN DB
ATTN0081 SUB*Q*W(MTEMP)
ATTN 82 STR*Q*W(ADJPRO+B2)
ATTN0083 ADD*Q*W(NW)'''SUM VALUES
ATTN0084 STR*Q*W(NW)'''SUM(NW-10LOGR)
ATTN0085 ENT*B2*1+B2'''INCREMENT COUNTER
ATTN 86 ENT*B1*1+B1
ATTN 87 MNG BSK*B1*W(LIMIT)
ATTN0088 JP*MSTART1'''NO
ATTN0089 ENT*Q*W(SUMR)'''YES,CONTINUE
ATTN008905 CL*A
ATTN 90 LSH*AG*33
ATTN 91 RJP*FIXFLT
ATTN 92 RJP*FLSTR
ATTN 93 RJP*FLMP
ATTN 9305 RJP*FLSTR
ATTN0094 STR*A*W(ASUMR)'''STORE PARTS
ATTN0095 STR*Q*W(QSUMR)
ATTN0096 ENT*A*0'''INITIALIZE
ATTN0097 ENT*Q*W(NOP)'''TOTAL RANGE VALUES SC 0
ATTN0098 LSH*AG*36'''SET OCTAL PT BET A AND Q REGISTERS
ATTN0099 RJP*FIXFLT'''CONVERT N TO FLT PT
ATTN0100 ENT*A*W(ASUMR2)'''SUMR(SQUARED) IN FLT PT
ATTN0101 ENT*Q*W(QSUMR2)
ATTN0102 RJP*FLMP'''NSUMR(SQ.) IN FLT PT
ATTN0103 ENT*A*W(ASUMR)'''(SUMR)SQUARED IN FLT PT
ATTN0104 ENT*Q*W(QSUMR)
ATTN0105 RJP*FLSB'''NSUMR(SQ.)-(SUMR)SQ. IN FLT PT
ATTN0106 RJP*FLSTR'''SET TO A AND Q
ATTN0107 STR*A*W(ADIVISOR)'''STORE PARTS
ATTN0108 STR*Q*W(QDIVISOR)
ATTN0109 ENT*A*0'''INITIALIZE
ATTN0110 ENT*Q*W(NOP)'''TOTAL NUMBER OF RANGE VALUES SC 0
ATTN0111 LSH*AG*36'''SET OCTAL PT BET A AND Q REGISTERS
ATTN0112 RJP*FIXFLT'''CONVERT TO FLT PT

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ATTN0113	RJP*FLSTR'''SET TO A AND Q
ATTN0114	STR*A*W(ANOP)'''STORE PARTS
ATTN0115	STR*Q*W(QNOP)
ATTN0116	CL*A
ATTN0117	ENT*Q*W(SUMR)
ATTN0118	LSH*AQ*33
ATTN0119	RJP*FIXFLT
ATTN0120	RJP*FLSTR
ATTN012005	STR*A*W(ASUMR1)
ATTN012010	STR*Q*W(QSUMR1)
ATTN012015	CL*A
ATTN012020	ENT*Q*W(NW)
ATTN012025	LSH*AQ*33
ATTN012030	RJP*FIXFLT
ATTN012035	ENT*Q*W(QSUMR1)
ATTN012040	ENT*A*W(ASUMR1)
ATTN 12045	RJP*FLMP
ATTN 12050	RJP*FLSTR
ATTN0121	STR*A*W(ASUBT)'''STORE PARTS
ATTN0122	STR*Q*W(QSUBT)
ATTN0123	ENT*Q*W(QNOP)'''TOTAL NUMBER OF RANGE PTS IN FLT PT
ATTN0124	ENT*A*W(ANOP)
ATTN0125	RJP*FLENT'''SET IN FLT PT REGISTER
ATTN0126	ENT*A*W(ASUMRNW)'''SET NSUMR(NW-10LOGR) TO A AND Q
ATTN0127	ENT*Q*W(QSUMRNW)
ATTN0128	RJP*FLMP'''NSUMR(NW-10LOGR) IN FLT PT REGISTER
ATTN0129	ENT*A*W(ASUBT)'''SET SUMRSUM(NW-10LOGR) TO A AND Q
ATTN0130	ENT*Q*W(QSUBT)
ATTN0131	RJP*FLSB'''NSUMR(NW-10LOGR)-SUMRSUM(NW-10LOGR) IN FP
ATTN0132	ENT*A*W(ADIVISOR)'''NSUMR(SQ.)-(SUMR)SQ.
ATTN0133	ENT*Q*W(QDIVISOR)
ATTN0134	RJP*FLDV'''ATTEN COEFF IN FLT PT REGISTER
ATTN0135	RJP*FLTFIX'''SET VALUE TO A AND Q SC 300
ATTN0136	RSH*AQ*17'''ATTEN COEFF SC 150 SET IN Q
ATTN0137	STR*Q*W(COEFF)'''STORE
ATTN0138	ENT*A*0'''INITIALIZE
ATTN0139	ENT*Q*W(SUMR)
ATTN0140	LSH*AQ*33'''SET OCTAL PT
ATTN0141	RJP*FIXFLT'''CONVERT TO FLT PT
ATTN0142	ENT*A*W(ASUMRNW)'''SUMR(NW-10LOGR) TO A AND Q
ATTN0143	ENT*Q*W(QSUMRNW)
ATTN0144	RJP*FLMP'''SUMRSUMR(NW-10LOGR)
ATTN0145	RJP*FLSTR'''SET TO A AND Q
ATTN0146	STR*Q*W(QRRNW)'''STORE PARTS
ATTN0147	STR*A*W(ARRNW)
ATTN0148	ENT*A*0'''INITIALIZE
ATTN0149	ENT*Q*W(NW)'''SUM(NW-10LOGR)
ATTN0150	LSH*AQ*33'''SET OCTAL PT
ATTN0151	RJP*FIXFLT'''CONVERT TO FLT PT
ATTN0152	ENT*Q*W(QSUMR2)'''SUMR(SQ.) IN FLT PT TO A AND Q
ATTN0153	ENT*A*W(ASUMR2)
ATTN0154	RJP*FLMP'''SUMR(SQ.)SUM(NW-10LOGR) IN FLT PT
ATTN0155	ENT*A*W(ARRNW)'''SUMRSUMR(NW-10LOGR)
ATTN0156	ENT*Q*W(QRRNW)
ATTN0157	RJP*FLSB'''SUMR(SQ.)SUM(NW-10LOGR)-SUMRSUMR(NW-10LOGR)
ATTN0158	ENT*A*W(ADIVISOR)'''NSUMR(SQ.)-(SUMR)SQ
ATTN0159	ENT*Q*W(QDIVISOR)
ATTN0160	RJP*FLDV'''TRANSITION RANGE IN FLT PT REGISTER

ATTN0161		RJP*FLTFIX'''CONVERT TO FIXED POINT SC 300
ATTN0162		RSH*AG*25'''TRANS. RANGE SC 9
ATTN0163		STR*Q*W(INTERCEPT)'''STORE
ATTN0164		STR*B0*W(DIF)'''INITIALIZE
ATTN0165		RPL*Y+1*W(LIMIT)'''RESTORE VALUE
ATTN0166		STR*A*Q
ATTN0167		ENT*A*0'''INITIALIZE
ATTN0168		DIV*2
ATTN0169		STR*Q*W(LIMIT2)'''STORE
ATTN0170		RPL*Y-1*W(LIMIT2)'''SET BSK VALUE
ATTN 171		ENT*B2*0
ATTN 172	LIM	ENT*Q*W(RANGE1+B2)
ATTN0173		MUL*W(COEFF)'''PREDICTED AR SC 180
ATTN 174		RSH*AG*90
ATTN0175		ADD*Q*W(INTERCEPT)'''AR+H SC 9 (PREDICTED)
ATTN0176		RSH*Q*6'''AR+H SC 3
ATTN 177		ENT*A*W(ADJPRO+B2)
ATTN0178		STR*A-Q*Q'''DIF
ATTN 179		STR*Q*W(MTEMP)
ATTN 17905		MUL*W(MTEMP)
ATTN0180		ADD*Q*W(DIF)'''SUM VALUES
ATTN0181		STR*Q*W(DIF)'''STORE SC 6
ATTN0182		BSK*B1*W(LIMIT2)'''COMPLETE SUM
ATTN0183		JP*LIM'''NO
ATTN0184		ENT*A*W(LIMIT2)
ATTN0185		SUB*A*1'''N-2
ATTN0186		ENT*Q*W(DIF)
ATTN0187		STR*A*W(MTEMP)'''TEM. STORE N-2
ATTN0188		ENT*A*0'''PREPARE TO DIVIDE
ATTN0189		LSH*AG*150
ATTN0190		DIV*W(MTEMP)'''DIF/N-2 SC 180
ATTN0191		STR*Q*W(SYN)
ATTN0192		SORT
ATTN0193		STR*Q*W(SEE)'''STAN. ERROR OF ESTIMATE SC 9
ATTN0194		ENT*A*W(ASUMR2)
ATTN0195		ENT*Q*W(QSUMR2)
ATTN0196		RJP*FLENT
ATTN0197		RJP*FLTFIX
ATTN019705		RSH*AG*300
ATTN019710		SORT
ATTN019715		STR*Q*W(MTEMP)
ATTN019720		ENT*Q*W(SYN)
ATTN019725		ENT*A*0
ATTN019730		DIV*W(MTEMP)
ATTN0198		SORT
ATTN0199		STR*Q*W(SERC)'''STAN. ERROR OF REG. COEFF. SC 150
ATTN0200		RETURN
ATTN0201	RANGE	RESERVE*10000
ATTN0202	RANGE1	RESERVE*5000
ATTN0203	ADJPRO	RESERVE*5000
ATTN0204		END-PROC*ATTENLOSS